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SIMULIIDAE
E. G. GIBBINS

MOSQUITOES
F. W. EDWARDS and E. G. GIBBINS



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2. SIMULIIDAE

By E. G. GIBBINS

(With Plate xxi)

DURING December 1934 while accompanying the British Museum East African Expedition the writer was able to devote a few days to the breeding of Simuliidae in the Namwamba Valley of Mount Ruwenzori. At the time of our visit the rains were subsiding, the level of the Namwamba was beginning to fall, and Simuliid larvae and pupae were plentiful on the surfaces of the huge boulders which cause an impediment in the river's course. The small collection made included five species, two of which proved new to science.¹ In order to make the study of the Simuliidae of the mountain more complete, details are included of *Simulium taylora* Gibbins which was taken by the writer from the Bwamba Pass in 1931. Adults of three additional species were captured by Dr. F. W. Edwards: *Simulium duodecimum* Gibbins was represented by a single male which was caught on the west side of Ruwenzori in the Bwamba Pass, *S. damnosum* Theobald by a single female taken in the vicinity of the River Mobuku at 4000 ft. and *S. cervicornutum* Pomeroy by six females which were taken on the window inside a bungalow at Kilembe (4500 ft.) where they made no attempt to bite. *Simulium dentulosum* and *S. kauntzeum* have been previously recorded from the Butahu Valley on the west side of the mountain (1936).

Simulium dentulosum and *S. kauntzeum* were found breeding at an altitude of 10,200 ft. in the Namwamba Valley of Mount Ruwenzori and *Simulium* larvae (species undetermined) were found by Mr. D. R. Buxton at 12,000 ft. in the Nyamgasani Valley. Hitherto it was not known that Simuliidae bred at such a high altitude. *S. dentulosum* and *S. masabae* were both breeding at an elevation of 9500 ft. on the slopes of Mt. Elgon, but though a thorough search was made in apparently identical watercourses at higher altitudes the early stages were not found.

Of particular interest was the discovery of three different forms of the pupal respiratory organ in *S. dentulosum*. While the adult differed only in size and was morphologically identical with the type in both sexes, the respiratory organ of the pupa conformed to three distinct forms with no apparent variation;

¹ These two species (*S. kauntzeum* Gibbins and *S. bisnovem* Gibbins) were at first described as new in the present report, but owing to delays in publication and to the fact that the author wished to refer to them in other papers, short preliminary diagnoses were published by him in 1938 (Ann. Trop. Med., 32.)—F. W. E.

these forms occurred separately at three localities at different altitudes in the course of the River Namwamba.

With the exception of *Simulium bisnovem*, of which larva is unknown, and *S. dentulosum*, early stages of which have already been described in an earlier communication, the present study includes an account of the larva and pupa of each species. The adults of both sexes of the new species are dealt with, while the male and female terminalia of *S. debegene* and *lepidum* and the male terminalia of *S. dentulosum* are redescribed and figured in greater detail. Notes on the breeding places are also given.

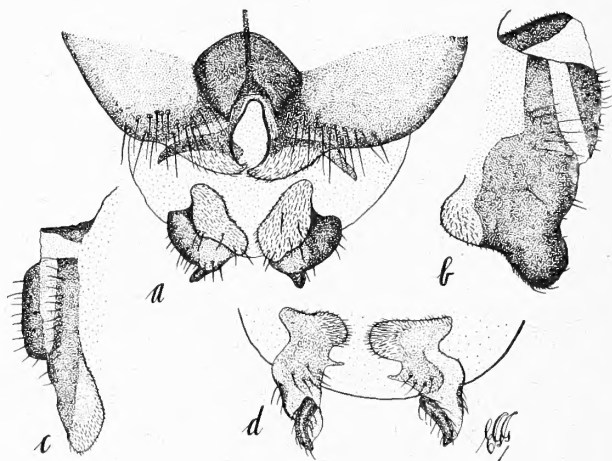


Fig. 1.—Female terminalia: *S. bisnovem* ventral view (a), paraproct and cercus, lateral view (b). *S. kauntzeum* paraproct and cercus, lateral view (c), ventral view (d).

***Simulium kauntzeum* Gibbins**

FEMALE: Length 4 mm.; wing 4.5 mm.

Head. Vertex and fronto-clypeus slate grey; vertex covered with silver and rather wide. **Antenna** black.

Thorax: *Mesonotum* dull black, uniformly covered with short golden scales and with long outstanding black hairs along the posterior margin. *Pleurae* slate-blue with a dense patch of pale golden scales on the membrane behind the thoracic spiracle. *Halteres* dark brown.

Abdomen lustrous dark brown, thinly and uniformly covered with short pale golden scales; these are interspersed with long outstanding black hairs on the seventh and eighth segments; first tergite brown with dense lateral fringe of pale yellow hairs, a few are of moderate length but the majority are short. **Spermatheca** oval and heavily chitinated; outer wall unsculptured. **Terminalia:**

Eighth sternite and anterior gonopophyses as in *S. bisnovem* but with the latter more densely covered with setae; paraproct and cerci as in Fig. 1, *c* and *d*.

Legs dark brown, coxae with long pale yellow scales, front femora sprinkled with yellow scales, front and hind tibiae with the basal two-thirds pale. Calcipala present and pedisulcus distinct. Claws with a well-developed basal projection.

Wings with spines interspersed with hairs on the costa, hairs on the basal two-thirds of the subcosta and base of the radius, the radial sector. the cubitus with a distinct double bend; basal cell present.

MALE. Length 4 mm.; wing 4.5 mm.

Head. Clypeus black with numerous long black outstanding hairs. Eyes closely approximated. *Antenna* as in female.

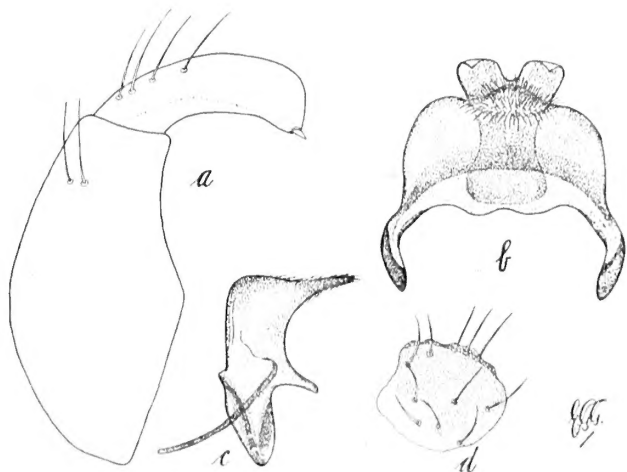


Fig. 2.—*Simulium kauntzeum*, Male terminalia: coxite and clasper (a); phallosome, anterior part, ventral view (b), lateral view (c), cercus (d).

Thorax. *Mesonotum* velvet-black covered with golden scales. *Scutellum* brown with narrow deep golden scales and long outstanding black hairs on the posterior margin. *Pleurae* brown with patch of very long narrow scales on the membrane behind the thoracic spiracle. *Halteres* dark brown.

Abdomen velvet-black, very sparsely covered with short deep golden scales; first tergite with dense lateral fringe of long pale hairs which are dark brown basally. *Terminalia*¹ (Fig. 2). *Coxite* large, about half as long again as the clasper; in ventral view it is convex outwardly with its inner side divided almost equally into a lower vertical and an upper slightly convex edge. The *clasper*, which bears a short tooth on its lower apical edge shows no reduction in width

¹ The terminology of the male terminalia used throughout this report is that described in a former paper (1935).

basally. *Phallosome*, anterior part (Fig. 2, *b* and *c*), broad in ventral view with a peculiarly long anterior projection bearing short setae; median process broad, short and bifid distally; posterior part as in *dentulosum*. *Cercus* (Fig. 2, *d*) circular with short stout bristles.

Legs dark brown. Front legs: femora sprinkled with silver scales and with very long dark brown hairs along the posterior edge; basal two-thirds of tibiae covered with silver scales. Middle legs: basal half of tibiae covered with yellow scales. Hind legs: basal third of tibiae with silver scales; first tarsal segment very broad; calcipala rounded and pedisulcus distinct.

Wings as in female but with a few hairs only on the base of the subcosta.

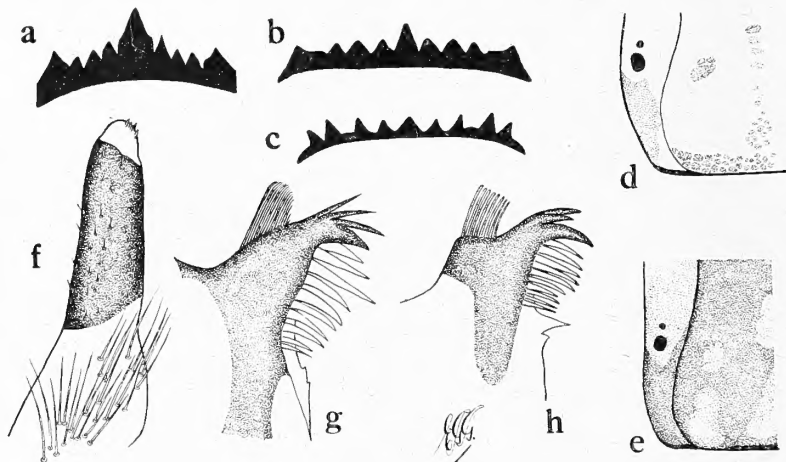


Fig. 3.—Larva. Terminal teeth of mentum of *S. kauntzeum* (*a*), *S. lepidum* (*b*) and *S. taylori* (*c*). Part of front to show pigmentation: *S. kauntzeum* (*d*), *S. debegene* (*e*). Palp of *S. debegene* (*f*). Mandible: *S. debegene* (*g*), *S. kauntzeum* (*h*).

LARVA. Length of mature larva 13 mm. General colour dark grey.

Head. *Front* with pigmented areas as in Fig. 3, *d*. *Antenna* normal, slightly longer than the base of the feeding brushes. *Palp* as in *S. debegene* but not so heavily chitinated. *Mandible* (Fig. 3, *h*) with 3 heavily chitinated teeth, one of which, the outer, is slightly longer than the rest and with 10 smaller lightly chitinated teeth which protrude from its concave surface; of the usual paired lateral teeth the upper is considerably larger than the lower which is small and inconspicuous. *Mentum* with a terminal row of the usual 9 heavily chitinated teeth as in Fig. 3, *a*, the median, which is large and prominent is about twice the length of the outer; on either side lie about 34 strong spines arranged irregularly two and three deep along the inner side of a heavily chitinated margin. *Feeding brushes* with about 50 bristles, some 14 of which are short.

Thorax. Pseudopod broad and long.

Abdomen with minute spines. Anal gills trilobed, the central lobe with 14 and the lateral with 12 finger-like processes. Anal armature normal. Circlet with about 300 rows of 30 to 35 strong hooks.

PUPA. *Head* and *thorax* with disc-like tubercles and short, slender, simple trichomes. *Respiratory organ* (Fig. 4, *a*) semi-translucent, composed of 9 long stout filaments with deeply-pigmented tips, 8 of which are arranged in pairs, and arise from short stems, and one stumpy spine-like basal process. Under high magnification the outer wall shows the fine striated appearance depicted in the figure and is slightly more pigmented than in the case of *S. bisnovem*.



Fig. 4.—Respiratory organ: *S. kauntzeum* (a), *S. bisnovem* (b), *S. debegene* (c).

Abdomen. Terminal segment without hooks or spines. *Dorso-lateral surface:* second segment with a pair of minute spines; third and fourth segments with four equally spaced hooks. *Ventro-lateral surface:* fourth segment with three minute spines, the inner of which is bifid; fifth, sixth and seventh segments with a pair of strong hooks, those on the two latter segments are widely spaced.

The cocoon is a gelatinous structure 6 mm. in length with a lateral projection as depicted in Fig. 5, *a*.

RUWENZORI: Namwamba Valley, Holotype ♂, bred from isolated pupa, Kiriruma (10,200 ft.), 25.xii.34 (Gibbins). Allotype ♀, and 8 ♂, same data, also 4 ♂, 1 ♀ captured, same locality (Edwards).

Simulium kauntzeum was found breeding in association with the large form of *S. dentulosum* on the surface of clean dark stones which were lying below cascades in the River Namwamba near Kiriruma at an altitude of 10,200 ft.; the river in this situation was swiftly flowing and partly shaded by tall tree heath.

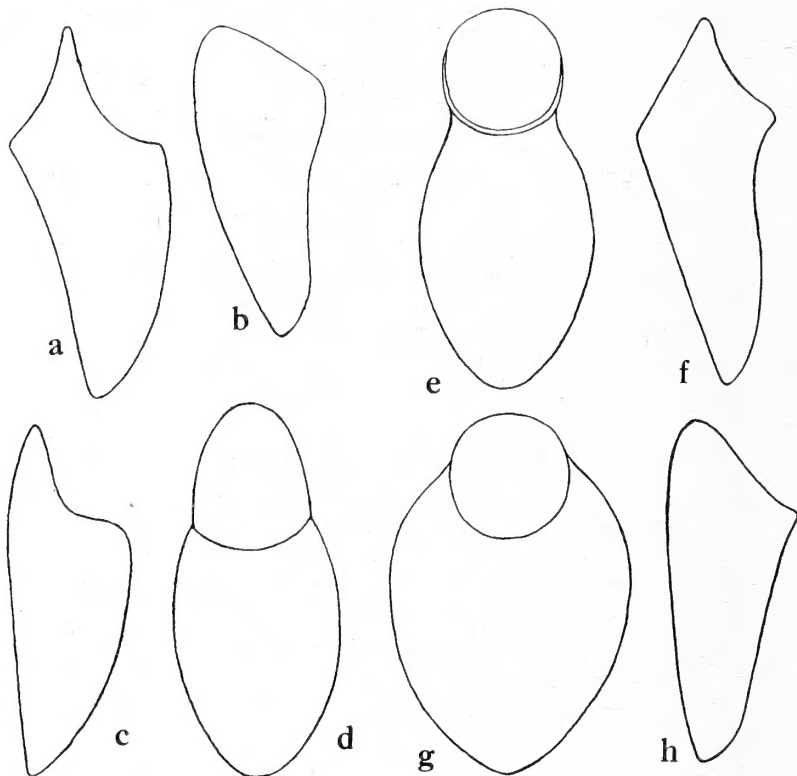


Fig. 5.—Cocoon. *S. kauntzeum* (a), *S. bisnovem* (b), *S. debegene* lateral view (c), ventral view (d); *S. lepidum* ventral view (e), lateral view (f); *S. taylori*, ventral view (g), lateral view (h).

***Simulium bisnovem* Gibbins**

FEMALE. Length 4.5 mm.; wing 5 mm.

Head. Vertex and fronto-clypeus slate-grey, covered with yellow scales which are interspersed with long black hairs. *Antenna* dark brown; scape, first and base of second flagellar segment light brown.

Thorax. *Mesonotum* coppery-brown, sparsely covered with short golden scales and broadly edged slate-blue with dense long narrow golden scales, bearing three long narrow dark blue longitudinal stripes of equal length; the outer stripes converging slightly on the median anteriorly. *Scutellum* coppery-brown with narrow golden scales interspersed with long black hairs and with a row of

long outstanding golden scales situated on either side on the posterior margin. *Pleurae* slate-blue without a patch of soft hairs on the membrane behind the thoracic spiracle. *Halteres* dark brown.

Abdomen lustrous dark brown. First and second segments densely covered with golden scales which are sparse on the remaining segments; first tergite brown with lateral fringe of yellow hairs of moderate length. *Terminalia* (Fig. 1, a). Eighth sternite with a median chitinized area; anterior gonopophyses thinly covered with fine setae and tapering slightly distally; paraprocts broad in ventral view and almost equally divided into a spiculate basal area and a heavily chitinized distal area; in lateral aspect (Fig. 1, b) its large size and heavily chitinized rounded anterior projection and spiculate basal area are clearly seen. The cercus is small.

Legs dark brown, femora sprinkled with golden scales; basal two-thirds of tibiae of front legs with silver scales and middle legs with yellow scales; hind legs with basal two-thirds of tibiae yellow and basal half of first tarsal segment with silver scales. Claws with a basal tooth.

Wings as in *S. kauntzeum* but lacking the basal cell.

MALE. Length 4 mm.; wing 4 mm.

Head. Front-clypeus slate-grey with long black hairs. *Antenna* dark brown with long dark hairs on the scape and first flagellar segment. Eyes closely approximated with a row of dark hairs between them.

Thorax. *Mesonotum* velvet-black, densely covered with long narrow golden scales; these are sparse in the median area and interspersed with long black hairs posteriorly. *Scutellum* with golden scales and long black marginal hairs. *Pleurae* and *halteres* as in female.

Abdomen velvet-black. Second, third and fourth segments with dense golden scales; fifth, sixth and seventh segments with sparse golden scales and a slate-blue iridescent lateral patch; first tergite dark brown with dense lateral fringe of long pale yellow hairs. *Terminalia* (Fig. 6). *Coxite* about the same length as the clasper and of similar shape to *S. kauntzeum*. *Clasper* tapering gradually to a pointed tip with a small chitinized terminal tooth. *Phallosome* anterior part (Fig. 6, b): small and heart-shaped with a long forward projection bearing setae and with long narrow basal processes which converge in the median area; median process large, broadening distally with a peculiar posterior flap on either side, posterior part (Fig. 6, c) membranous with strong spines and a long narrow apodeme. Cercus as in Fig. 6, d.

Legs as in female except for the presence of long dark brown hairs on the front femora, golden scales on the mid femora and silver scales on the first hind tarsal segment which is wide and rounded apically.

Wing as in female but with a basal cell.

LARVA. Unknown.

PUPA. *Head* and *thorax* with sparse disc-like tubercles and simple trichomes.

Respiratory organ (Fig. 4, *b*) pale and semi-translucent, comprising 18 stout filaments arranged in pairs with deeply pigmented tips and a finely striated outer wall.

Abdomen. Terminal segments with a pair of inwardly curved hooks. *Dorso-lateral surface:* first and second segments with four closely placed short spicules; third and fourth segments with four closely placed strong hooks. *Ventro-lateral surface:* sixth, seventh and eighth segments with a pair of strong hooks; those on the seventh and eighth segments widely spaced.

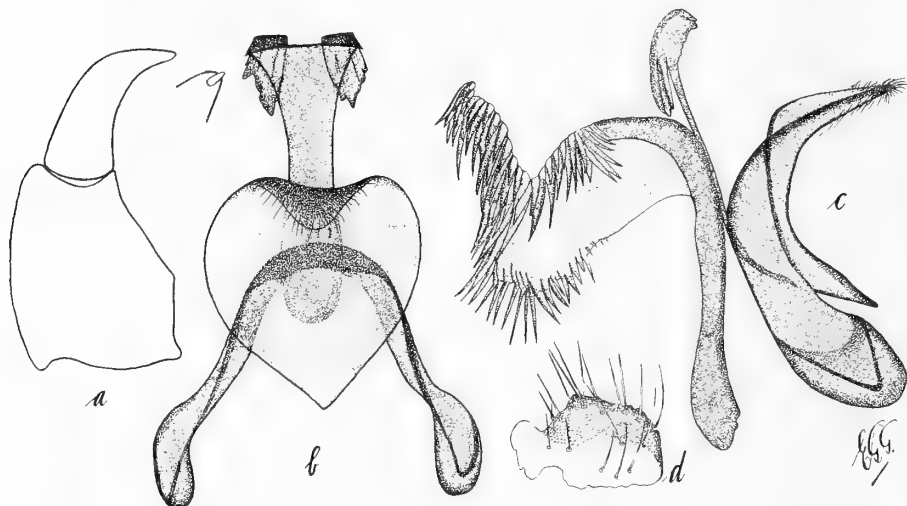


Fig. 6.—Male terminalia. *Simulium bisnovem*, coxite and clasper (*a*); phallosome, lateral view (*c*), anterior part, ventral view (*b*), cercus (*d*).

The cocoon is a gelatinous pocket 5 mm. in length as illustrated in Fig. 5, *b*.

RUWENZORI: Namwamba Valley, 6500 ft., type ♂ and allotype ♀ bred from isolated pupae (*Gibbins*), also 2 ♂ 1 ♀ caught (*Edwards*); Bwamba Pass, 17.xi.1931, 1 ♂ bred from pupa (*Gibbins*).

A few pupae of *Simulium bisnovem* were found attached to slender tree roots dangling in a cascade in the river near Kyanjoke (6500 ft.). The writer collected a single pupa of this species from the River Mpanga at about 6000 ft. on the Ruwenzori foothills in the Bwamba Pass in 1931. In this case the pupa came from a small stone lying beneath a cascade and was associated with numerous pupae of *S. dentulosum*. This specimen, from which a male was bred, was previously referred to as N2 (1934).

***Simulium dentulosum* Roubaud**

In the River Namwamba three distinct forms of *Simulium dentulosum* were found breeding; these are easily separable on the character of the respiratory

organ of the pupa, but apart from a difference in size the adults of both sexes were identical with those from the type locality. At Kiriruma, (10,200 ft.), the highest altitude at which *Simulium* were taken by the writer, pupae of a large form were occurring in association with those of *S. kauntzeum*. This form measured 4.6 mm. with a wing of 4.5 mm. as against 3.5 mm. and 3.7 mm. respectively in specimens from the type locality. No distinction was noted in the terminalia of the adult and the pupae differed only in size and in the size and comparative length of the

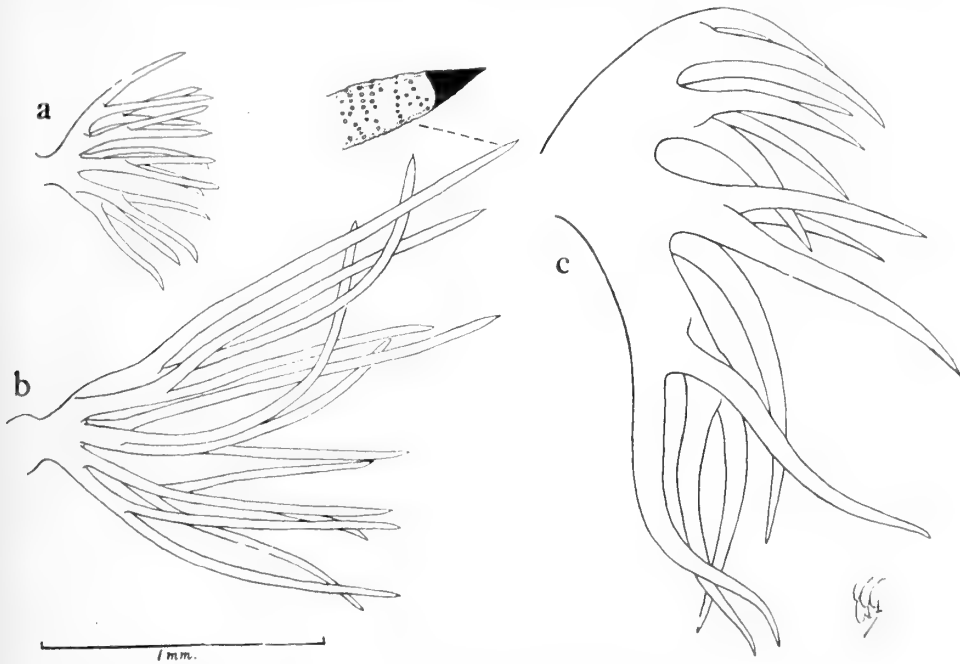


Fig. 7.—*Simulium dentulosum*. Respiratory organ of pupa. Kilembe form (a), Kiriruma form (b), Kyanjoke form (c). (Drawn to the same scale.) It should be noted that owing to the fact that the pupae of the forms (b) and (c) are very much larger than those of (a) difference in relative size of the respiratory organs is not so great as appears in the drawings.

individual filaments of the respiratory organ. Lower down the river, at Kyanjoke (6500 ft.), associated with the early stages of *S. bisnovem*, pupae were obtained of a form from which the bred adult was slightly larger than that of the type. Though exhibiting no distinguishing characters externally or in the male terminalia the pupal respiratory organ was conspicuously different and larger than in any of the other forms. Still lower in the river's course, at Kilembe (4500 ft.), the smaller form was found which had a respiratory organ similar to that of pupae from the type locality from which typical adults of *S. dentulosum* have been bred. The three forms of the respiratory organ of the pupa, drawn to the same scale, are illustrated in Fig. 7. It will be seen that the filaments

number 14 and are paired in all cases. While they arise similarly in the Kilembe (Fig. 7, *a*) and the Kiriruma (Fig. 7, *b*) forms in the latter the two lateral pairs on one side are considerably longer than the rest, whereas in the Kilembe (type) form all the filaments are of uniform length. In the Kyanjoke form (Fig. 7, *c*), in which this organ is the largest of the three, the filaments are much stouter and the base is broad and bladder-like with a short lateral arm supporting two pairs of filaments. The general arrangement and sculpture of the outer

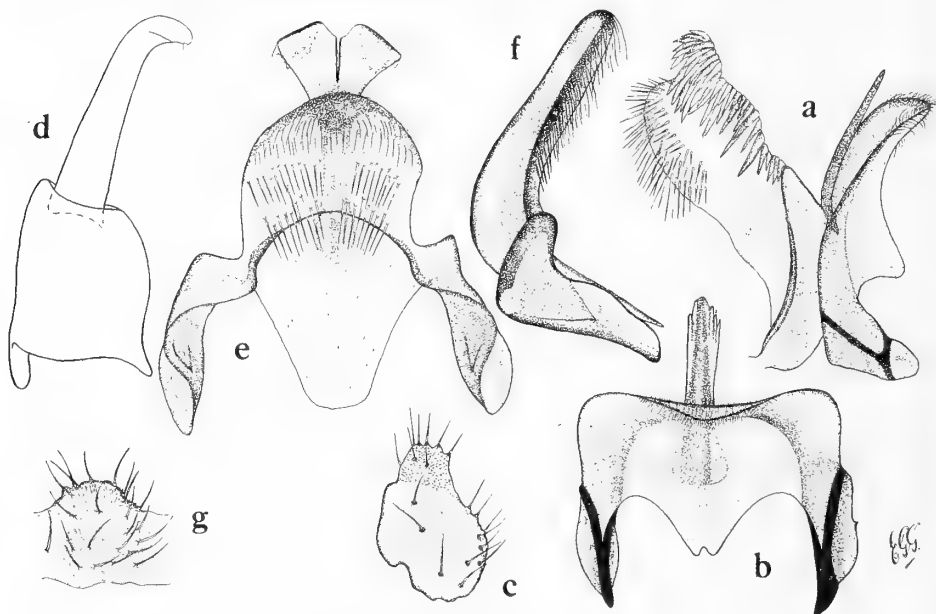


Fig. 8.—Male terminalia: *Simulium dentulosum*, phallosome, lateral view (*a*), anterior part, ventral view (*b*), cercus (*c*); *S. debegene*, coxite and clasper (*d*), phallosome, anterior part, ventral view (*e*), lateral view (*f*), cercus (*g*).

wall of the filaments is similar in every case though in the Kyanjoke form the pigmented nodules are more widely spaced.

The terminalia (Fig. 8, *a-c*) of an isolated specimen from the type locality have been dissected and the parts are shown in order to facilitate the accurate determination of the species.

***Simulium debegene* De Meillon**

Dr. De Meillon's description (1934) of the male and female is supplemented by the following notes on the terminalia.

FEMALE. The terminalia shown in ventral and lateral aspect in Fig. 9, *a* and *b*, have been clearly described. The characteristic paraproct is more highly developed than in any other known African species.

MALE. Fig. 8, *d-g*, shows the terminalia which were dissected out from a mature pupa. The coxite is small, about half as long as the clasper which is slender and tapers gradually to a rounded end bearing a small tooth on its lower extremity. *Phallosome*, anterior part (Fig. 8, *e* and *f*) rounded anteriorly with rows of downward projecting spines covering its ventral surface and with large basal processes; median process bifid, expanded distally with a posterior flap on either side; posterior part similar to *S. bisnovem* but with fewer and shorter

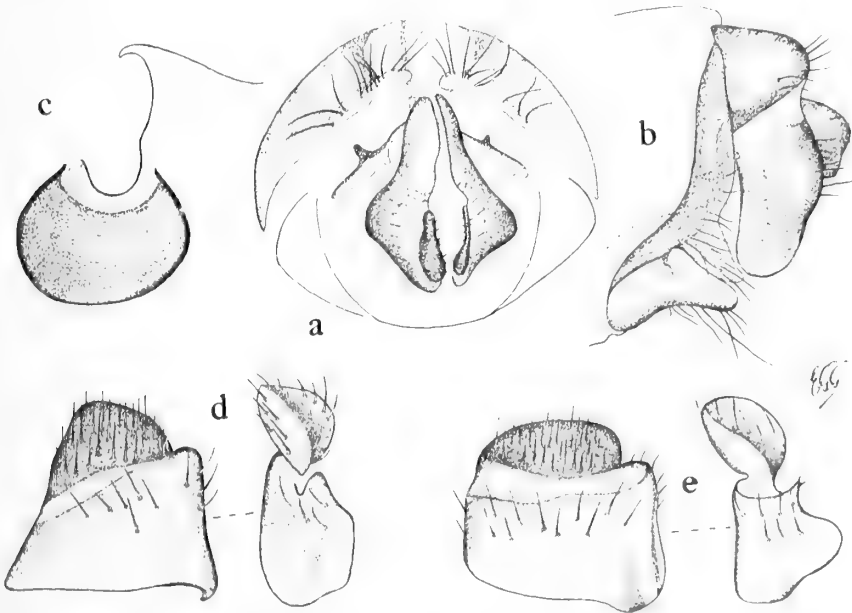


Fig. 9.—Female terminalia. *Simulium debegene*, ventral view (*a*), lateral view (*b*). *S. lepidum*, eighth sternite and right anterior gonapophyse (*c*), paraproct and cercus, lateral and ventral views (*e*); *S. taylori*, paraproct and cercus, lateral and ventral views (*d*).

spines and without spines on the lower surface of the membrane; apodeme somewhat shorter. Cercus as in Fig. 8, *g*.

LARVA. Length of mature larva 9 mm. General colour dark grey.

Head. *Front* heavily chitinized and sparsely spiculate with irregular pale patches as in Fig. 3, *e*. *Palp* (Fig. 3, *f*) with a very heavily chitinized broad band, covered with short spines bearing numerous long slender bristles on its unchitinized base. *Antenna* normal about as long as the base of the feeding brushes. *Mentum* with the usual terminal row of nine heavily chitinized teeth (which were somewhat broken in the only specimen of this species taken) with a single oblique row of eight to nine stout spines on either side. *Mandible* (Fig. 3, *g*) with a main and three smaller heavily chitinized teeth situated above and with

ten secondary teeth; the usual paired lower teeth are small and inconspicuous. *Feeding brushes* with about 57 long and 12 short bristles.

Thorax. Pseudopod broad and long.

Abdomen. Normal. Anal gills trilobed, each lobe with 10 to 12 finger-like processes. Circlet with about 320 rows of 60 to 70 strong hooks.

PUPA. *Head and thorax* with disc-like tubercles and short simple trichomes. Respiratory organ (Fig. 4, c) pale and semi-translucent, composed of four long uniform filaments, three of which arise posteriorly; they have a finely reticulated outer wall with rounded ends.

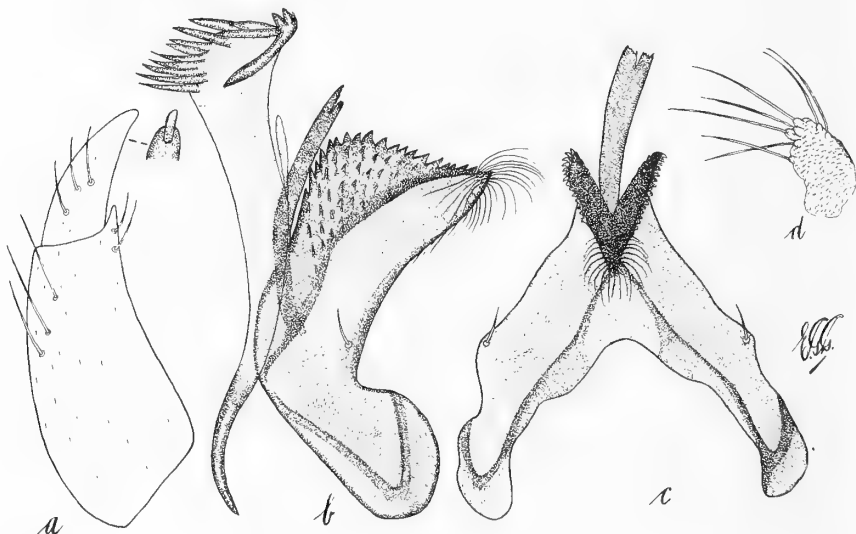


Fig. 10.—Male terminalia. *Simulium lepidum*, coxite and clasper (a); phallosome, lateral view (b), anterior part, ventral view (c), cercus (d).

Abdomen without terminal hooks or spines. *Dorso-lateral surface*: second segment with five minute spines, third and fourth with four equally spaced strong hooks, sixth, seventh, and eighth with a small spiculate patch. *Ventro-lateral surface*: fourth segment with two short heavily chitinized spines, sixth and seventh with a pair of strong hooks; those on the latter segment widely spaced, eighth with a simple lateral hook.

The cocoon (Fig. 5, c and d) is a sheath-like gelatinous structure 5.5 mm. in length.

RUWENZORI: Namwamba Valley, Kyanjoke (6500 ft). Two pupae and one larva were taken from stones removed from cascades in the river which was heavily shaded by dense forest on either side; one adult female was reared.

Originally described from specimens obtained at Magoebaskloof, Tzaneen, in the Transvaal at 3-4000 ft.

Simulium lepidum De Meillon

The male and female were described by De Meillon (1935). Below the terminalia of both sexes are redescribed and figured in greater detail. The larva is described for the first time and a full description of the pupa is also given.

FEMALE.

Terminalia (Fig. 9, *c* and *e*). Eight sternite with a lightly chitinized median area; anterior gonopophyses long and tapering almost to a point; paraproct in ventral view with a large rounded median process on its inner side and a small anterior projection armed with a pair of spines. Cercus small.

MALE.

Terminalia (Fig. 10). *Coxite* (Fig. 10, *a*) about twice the length of the clasper, slightly narrower apically than basally with a short inner anterior projection. *Clasper* tapering gradually to the tip which bears a single broad chitinized tooth. *Phallosome* (Fig. 10, *b*) anterior part (Fig. 10, *c*) simulating an inverted V in ventral view with a chitinized V shaped anterior end serrated outwardly with a basal tuft of long hairs; in lateral view it is broad, serrated anteriorly and armed with a strong tooth-like process on its posterior surface, the downward projecting processes are broad and rounded basally; median process long and narrow; posterior part membranous and bearing large backwardly projecting spine-like processes. Cercus (Fig. 10, *d*) small and with about seven long apical bristles arising from boss-like bases.

LARVA. Length of mature larva 9 mm. General colour grey.

Head. *Front* lacking pigmented areas. *Antenna* normal, slightly longer than the base of the feeding brushes. *Mandible* with three main heavily chitinized teeth, the median of which is shorter than the rest and with seven smaller lightly chitinized teeth which protrude from its concave surface; of the usual paired lateral teeth the upper is slender, pointed and considerably longer than the lower which is small and inconspicuous. *Mentum* with a terminal row of nine heavily chitinized teeth (Fig. 3, *b*); with the exception of the median which is considerably the longest all are of uniform length, the outer bearing a shoulder on its inner edge; on either side is a single oblique row of 6 to 7 strong spines and in the sub-median basal area lies a single spine which is equal in length to the smallest. *Feeding brushes* with 40 to 50 long bristles.

Thorax. Pseudopod short and broad reaching just above the head suture.

Abdomen. Terminal segments with scattered minute spines on the dorsal surface. Anal gills trilobed; in addition to one large process the median lobe has six and the outer five small finger-like processes. Anal armature normal. Circlet with about 220 rows of about 35 to 40 strong hooks

PUPA. *Head* and *thorax* with numerous large disc-like tubercles; trichomes simple with the exception of two pairs situated near the ventral suture; these are long and slender with two branches and arise from a short stem. *Respiratory organ* (Fig. 11, b). Arising medially from a broad base are three upright stems each bearing a single lateral branch and eight slender filaments which arise singly from the ventral surface. The latter are fragile and semi-translucent, whereas the single-branched main stems, which have near the base an outer wall covered with small nodules as depicted in the figure, are strong and pigmented. Two of the main stems unite a short distance above the third and on either side at the base lying horizontal and in contact with the pupa is a single semi-translucent caudal appendage.

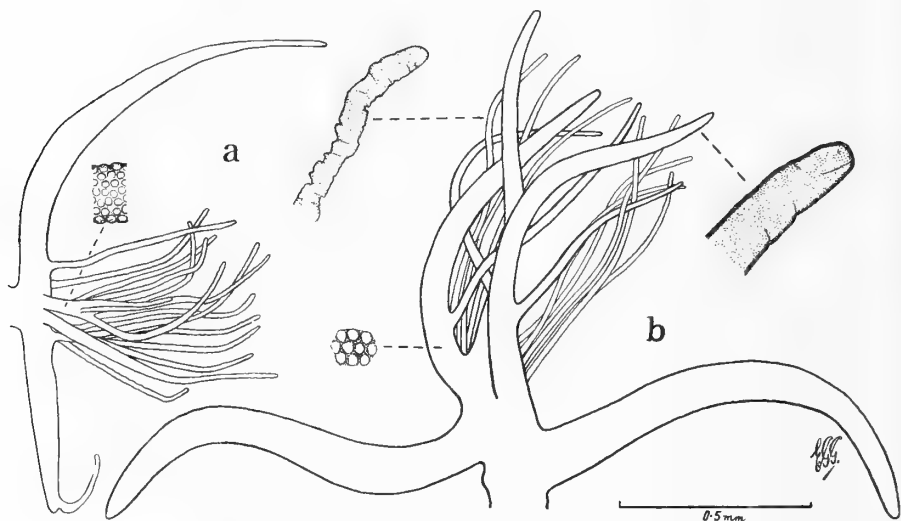


Fig. 11.—Respiratory organ of pupa. *S. taylora* (a), *S. lepidum* (b).

Abdomen. Dorso-lateral surface: third and fourth segments with four equally spaced strong hooks. *Ventro-lateral surface:* sixth, seventh and eighth segments with a pair of hooks; these are widely spaced on the last two.

Cocoon (Fig. 5, e and f) 4 mm. in length, dark brown and gelatinous.

RUWENZORI: Namwamba Valley, near Kilembe (4500 ft.), Pupae on loose stones (Edwards).

Larvae and pupae from which many adults were reared were also found in abundance by the writer on the face of vertical rock and on the blades of elephant grass dipping in the swiftly flowing River Nabigwo on Mt. Nkokonjeru (Eastern Uganda) at an altitude of about 6000 ft.

***Simulium taylori* Gibbins**

FEMALE. Length 3 mm.; wing 3.5 mm.

Head. Vertex and *fronto-clypeus* slate-grey, covered with dark hairs. *Antenna* dark brown. *Palp*: sensory spot small and circular.

Thorax. *Mesonotum* dull black, densely covered with brassy scales which are interspersed with outstanding long black hairs posteriorly. *Pleurae* slate blue, lacking hairs on the membrane behind the thoracic spiracle. *Halteres* light brown.

Abdomen dull black, covered with golden scales laterally; first tergite dark brown with dense lateral fringe of pale hairs; dorsal surface with deep reddish

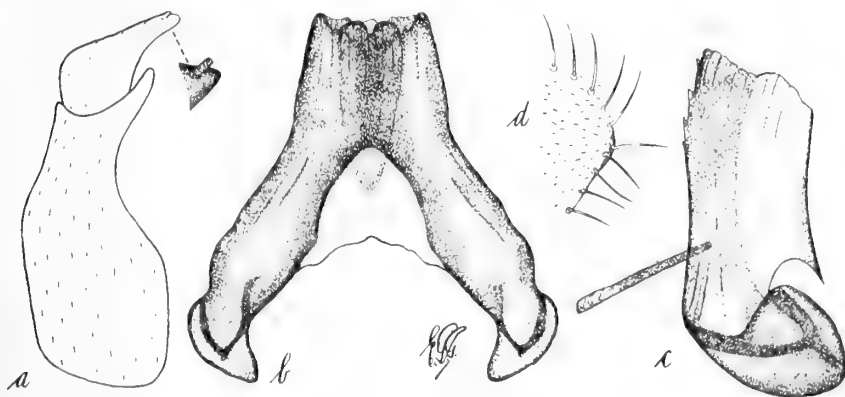


Fig. 12.—Male terminalia. *Simulium taylori*, coxite and clasper (a), phallosome, anterior part: ventral view (b) lateral view (c); cercus (d). (Posterior part of phallosome as in *S. lepidum*.)

brown scales with the exception of the first and second segments which are densely covered with long narrow golden scales. **Terminalia.** Eighth sternite as in *lepidum*. Paraproct (Fig. 9, d) differing noticeably from that of *lepidum* in the character of its inner side which lacks the median bulge when seen in ventral aspect.

Legs brown, basal half of femora of front legs with golden scales; basal two-thirds of front and mid tibiae and basal half of hind tibiae and first tarsal segment with silver scales. Calcipala present and pedisulcus distinct. Claws simple.

Wings with a basal cell, hairs along the sub-costa and on the base of the radius.

MALE. Length 2.5 mm.; wing 3 mm.

Head. Clypeus slate-grey, covered with outstanding long black hairs. *Antenna* dark brown.

Thorax. *Mesonotum* velvet-black, densely covered with long narrow golden

scales. Scutellum velvet-black with sparse golden scales and dense outstanding long black hairs. *Pleurae* as in female. *Halteres* dark brown.

Abdomen velvet-black, thinly covered with narrow dark brown scales and with a lateral, broad, diagonal slate-blue patch extending from the apical edge of the fifth to the seventh segment; first tergite dark brown with dense long dark brown hairs. *Terminalia* (Fig. 12). *Coxite* (Fig. 12, *a*) about twice the length of the clasper and in ventral view showing a constriction in the anterior third with a long inner apical projection. *Clasper* tapering from the distal two-thirds to a rounded tip with a sub-apical chitinated tooth. *Phallosome*, anterior part (Fig. 12, *b* and *c*) similar in shape to *S. lepidum* but smaller apically and lacking the tuft of long hairs; median process short and broad; posterior part as in *lepidum*. *Cercus* (Fig. 12, *d*) indistinct with setae round its outer edge.

Legs dark brown, tibiae with basal two-thirds of front legs and basal third of middle legs with silver scales; hind tibiae with a small basal patch of yellow scales.

Wings with basal cell and hairs on the base of the radius; sub-costa lacking hairs.

LARVA. Length of mature larva 7 mm. General colour grey.

Head. Front without pigmented areas. *Antenna* normal, slightly longer than the base of the feeding brushes. *Mandible* as in *lepidum*. *Mentum* as in *lepidum* with the exception of the terminal row of heavily chitinated teeth which are of similar length (Fig. 3, *c*). *Feeding brushes* as in *lepidum*.

Thorax. Pseudopod as in *lepidum*.

Abdomen without scales or spines. *Anal gills* trilobed, long and simple, *Anal armature* normal. *Anal circlet* as in *lepidum*.

PUPA. *Head* and *thorax* with disc-like tubercles and simple trichomes. *Respiratory organ* (Fig. 11, *a*). From a main slightly chitinated broad basal appendage arise 15 slender semi-translucent filaments; these arise singly with the exception of seven, which originate from two short stems covered with small nodules as depicted in the figure. The two stems arise on the dorsal surface and support a pair and five filaments respectively, one of the latter group being considerably shorter than the rest. Unlike that of *lepidum* the basal appendage is not identical on either side: one side, the longer, tapers to the tip while the other is rounded and bears a short sub-apical semi-translucent filament on its upper surface.

Abdomen as in *lepidum*.

Cocoon (Fig. 5, *g* and *h*), 2.5 mm. in length, dark brown and gelatinous.

RUWENZORI: Bwamba Pass, 17.xi.1931, type ♂, allotype ♀, and 5 ♂ 1 ♀ paratypes reared from isolated pupae (Gibbins).

Simulium taylori was found breeding in association with *S. dentulosum* and *S. bisnovem* in the Bwamba Pass of Mount Ruwenzori at an altitude of about 7000 ft. Larvae and pupae were present in small numbers on clean stones which

were removed from below cascades in heavily shaded parts of the River Mpanga. The pupae were easily distinguished from those of the other two species on account of their small size and less obvious respiratory filaments.

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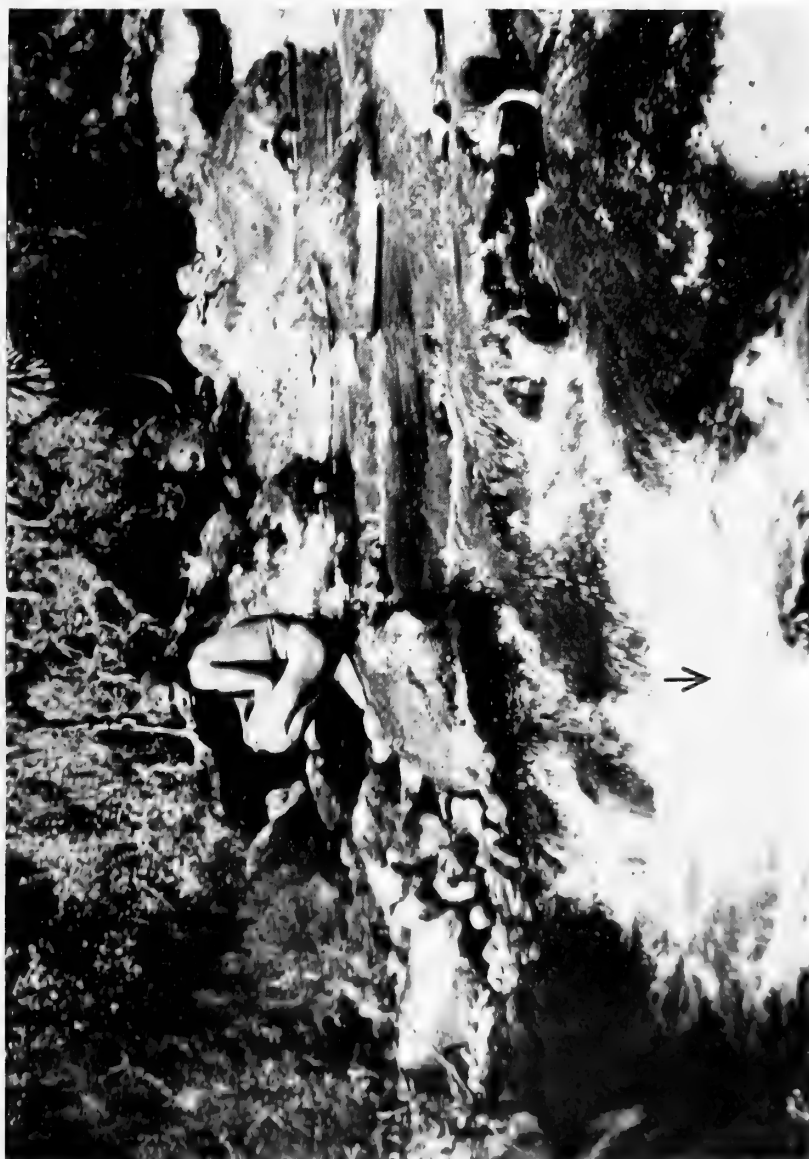
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Plate XXI

RUWENZORI

River Namwamba at 10,200 feet.

Habitat of *Simulium kauntzeum* Gibbins



3. MOSQUITOES

By F. W. EDWARDS and E. G. GIBBINS

(With Plate xxii)

DURING the British Museum Expedition of 1934-5 special attention was given to the mosquitoes of the bamboo zone on the Birunga Mountains and Ruwenzori; not only were the ground-pools in swampy areas of this zone examined, but the bamboos themselves were subjected to careful search. Several species were found breeding in the bamboo stems, the larvae being taken in clear water, a few inches deep, lying above nodes in the stems of growing bamboo damaged by a boring caterpillar. Large numbers of bamboo stems were examined and the results showed that those with a narrow hole about 12 by 6 mm. were most favoured. A hole of smaller dimensions appeared to be of insufficient size to allow the female to enter. The procedure adopted was to saw off a likely looking piece of bamboo, which by its sound on tapping indicated the presence of water, some distance above and just below the node, taking care not to split the stem. Its contents were then emptied into a receptacle and the inside thoroughly washed out two or three times with clean water as invariably some of the larvae stayed behind.

The most interesting results of this investigation were: (1) the discovery of three new species of Culicine mosquitoes (*Aedes angustus*, *A. bambusae* and *A. gibbinsi*), diagnoses of which have been published by Edwards* (Bull. Ent. Res., 26: 134-135, 1935); and (2) the demonstration of the similarity in the mosquito fauna of the bamboo zone of these two mountain ranges. In some parts of tropical Africa species of the subgenus *Dunnius* and other species of *Aedes* of the *apicoannulatus* group are characteristic inhabitants of the bamboos, but none of these was found in Uganda.

Search was also made for mosquito-larvae in the tree-heath and *Senecio* zones, above the bamboo, but none was found. It would seem that on these mountains mosquitoes do not occur above about 9000 ft. altitude.

More numerous species were obtained in the foothills of Ruwenzori, but these are of no special interest, all being widely distributed and well-known forms.

All the species obtained during the 1934-5 expedition in these areas are enumerated below, and in order to complete the list of mosquitoes known to occur on Ruwenzori some earlier records are noted, and a note is also included of further specimens obtained by Mr. J. F. Shillito in 1936.

* Fuller descriptions and figures of these species will appear in Part III of "Mosquitoes of the Ethiopian Region," now in preparation.

1. THE BAMBOO ZONE IN KIGEZI

(BIRUNGA AND NEIGHBOURING MOUNTAINS)

Anopheles Meigen

Anopheles garnhami Edw. A single male reared from a larva found in a swamp in the saddle between Mts. Mgahinga and Sabinio (Lugezi Camp), altitude about 8000 ft. This was the only species of *Anopheles* found on the mountains, and apparently it has a wide distribution at a rather high altitude in East Africa; specimens were also taken during the course of the expedition on Mt. Kinangop, Aberdare Mts., at about 8000 ft., and on Mt. Elgon (Kenya side) at about 11,000 ft.

Uranotaenia Lynch

Uranotaenia shillitonis Edw. Larvae numerous in bamboos, both on Mts. Mgahinga and Sabinio and on the Kigezi mountains at Kanaba and Muko, under the circumstances noted in the introduction to this paper. Neither adults nor larvae differ in any appreciable respects from those from the type locality (Fort Portal district).

Aedes Meigen

Aedes (Stegomyia) bambusae Edw. Larvae numerous in bamboos in all the above localities, in company with the *Uranotaenia*.

Aedes (Stegomyia) angustus Edw. Taken together with the last two species; it was perhaps commoner than *A. bambusae* at Muko, whereas the reverse was the case in the Birungas.

Aedes (Aedimorphus) dentatus Theo. Larvae numerous in a rather open temporary swamp at Kanaba Gap, and also at Lugezi Camp.

Aedes (Aedimorphus) gibbinsi Edw. Larvae numerous in swamp near Lugezi Camp in company with *An. garnhami* and the species of *Culex* mentioned below. Adults also taken biting in the bamboo forest here, and also in the bamboo zone of the Kigezi Mts., near Behungi by E. G. Gibbins in December 1932.

Eretmopodites chrysogaster Graham. At Muko, in a locality where the bamboo had been cut, the larvae were numerous in the open stumps, and in a fallen bamboo pole, lying nearly horizontal, which had been split open along its upper surface and become partly filled with rain-water, the early stages were associated with those of *Aedes (Stegomyia) angustus*.

Culex Linnaeus

Culex andersoni Edw. Larvae of this species were found at Muko in the fallen split bamboos just mentioned; they occupied the lower sections of the

bamboo whereas the *Aedes* and *Eretmopodites* were in the upper sections. Larvae were also found (and one male bred) in a small rock pool in the bed of a temporary stream at 7000 ft. on Mt. Muhavura.

Culex ninagongoensis Edw. Larvae were numerous in the swamp near Lugezi camp in company with *Aedes gibbinsi*.

Culex vansomereni Edw., ssp. n. **macrophyllus**. Many adults of a species of *Culex* closely resembling *C. vansomereni*, though showing a slight difference in male genitalia from typical specimens from Kenya, were bred from larvae found in the swamp at Lugezi camp. Unfortunately no isolated larval skins were preserved, but whole larvae from the same source bore a close resemblance to *C. andersoni* (a species of which no adults were reared or seen in the locality), and certainly did not exhibit the marked characteristics of *C. vansomereni*. If, as seems almost certain, these larvae belonged to the adults mentioned above, it is probable that the form must be treated as specifically distinct from both *C. andersoni* and *C. vansomereni*. Meanwhile the above subspecific name is proposed for the adult, the male hypopygium of which differs from the typical form in the much larger leaf on the lobe of the coxite, and slightly in the form of the teeth on the mesosome, and in the shape of the style. In addition ssp. *macrophyllus* differs from typical *vansomereni* (in both sexes) in having no scales on a small area immediately below the subalar knob of the pleurae.

Culex pipiens L. This species did not occur in the bamboo zone, but was found by Ford breeding in great numbers in the fringing swamps of Lake Mutanda.

2. THE BAMBOO ZONE ON RUWENZORI

Megarhinus Robineau-Desvoidy

Megarhinus sp. Two or three larvae of a *Megarhinus* were obtained by our native collector Kabanga in bamboos in the Nyamgasani Valley; unfortunately all of them died after arrival in the laboratory in Kampala, so that specific determination was impossible. Hancock (1932) records finding a *Megarhinus* pupa in a bamboo on the Bwamba pass, and suggests that it may have been *M. aeneus* Evans.

Uranotaenia Lynch

Uranotaenia shillitonis Edw. Also found in bamboos in the Nyamgasani Valley; previously recorded by Hancock from bamboos on the Bwamba Pass. It is not confined to the bamboo zone, the first specimens having been obtained by Shillito from reeds at Nyakasura, near Fort Portal.

Aedes Meigen

Aedes (Aedimorphus) gibbinsi Edw. At Kararama Camp, Namwamba Valley, 8000 ft., in ground pools of muddy water.

Culex Linnaeus

Culex nebulosus Theo. This was reported by Hancock as occurring in both open and bored bamboos on the Bwamba Pass. It was not found in the bamboo zone during the 1934-5 expedition.

Culex ninagongoensis Edw. In ground pools at Kararama Camp, associated with *Aedes gibbinsi*. Also recorded by Hancock from the Bujuku Valley.

Culex hopkinsi Edw. Found in company with the last at Kararama Camp.

Culex andersoni Edw. In company with the last.

Culex vansomereni Edw. ssp. n. *toroensis*. In company with the last. These specimens have the male hypopygium almost exactly as in the typical form, and do not show the enlarged leaf and other slight peculiarities seen in specimens from Kigezi; on the other hand they agree with ssp. *macrophyllus* in having no subalar scales. Quite similar specimens were obtained by Shillito in 1936 at Kisomoro, near Fort Portal, one male being reared from an isolated larva similar to that figured by Hopkins (Mosq. Ethiop. Reg., 1: 211) as *Culex* sp. indet.; it would seem therefore that Hopkins' peculiar *Culex* larva (recorded from Mihunga, Mobuku Valley, Ruwenzori, as well as from Mt. Elgon) can only be a variety or subspecies of *C. vansomereni*.

Culex moucheti Edw. Breeding in bamboo stump at Izahura, Bwamba (Shillito, 1936).

3. THE FOOTHILLS OF RUWENZORI

The following list could no doubt be considerably extended, as many if not all the species occurring in the surrounding country are likely to extend into the foothills. A few species additional to those noted below have previously been recorded from the Fort Portal district, just outside the mountain area.

Anopheles implexus Theo. Kalinzu Forest (*Jackson*); Kibale Forest (*Edwards*).

A. gambiae Giles. Kilembe.

A. marshalli var. *gibbinsi* Evans. Nyakasura.

A. demeilloni Evans. Nyakasura; Kilembe.

Megarhinus brevipalpis v. *conradti* Grünb. Buhundo.

Uranotaenia bilineata Theo., var. Kilembe. The specimens collected are badly rubbed, but agree with the var. *obsoleta* Edw. in the faint rings and indistinctly pale tips of the hind tarsi. The type of var. *obsoleta* was from Kasakiro, near Fort Portal. (*Gibbins*).

Uranotaenia mashonaensis Theo. Kilembe, in small swampy patch of forest, with the last.

U. shillitoni Edw. Nyakasura.

Taeniorhynchus (*Coquillettidia*) *fuscopennatus* Theo., Mobuku Valley, 7300 ft., 1 ♂.

T. (C.) maculipennis Theo. Kilembe.

Aedes (*Stegomyia*) *aegypti* L. Kilembe.

A. (S.) simpsoni Theo. Kilembe; larvae in leaf-axils of *Colocasia*.

A. (S.) apicoargenteus Theo. Kilembe, around hollow tree.

A. (S.) africanus Theo. Kilembe.

A. (Aedimorphus) tarsalis Newst. Kilembe.

A. (Aed.) quasiunivittatus Theo. Mobuku Valley, 7300 ft., 1 ♂.

Culex nebulosus Theo. Kilembe; larvae in old wheelbarrow.

C. duttoni Theo. Mobuku Valley, 1 ♂ at light.

C. andersoni Edw. Kyanjoke Camp, Namwamba Valley; larvae in small tree-hole with clear water near ground-level.

C. hopkinsi Edw. Recorded from Kameranjoka (*Hopkins*).

C. triflatus Edw. var. Kameranjoka (*Hopkins*).

C. musarum Edw. Nyakasura; also Mobuku Valley, larvae in leaf-axils of wild banana.

C. kingianus Edw. Kilembe; adults in small swampy patch of forest.

Plate XXII

BIRUNGA MOUNTAINS

Mt. Mgahinga and its Bamboo Forest. View from Lugezi Camp





